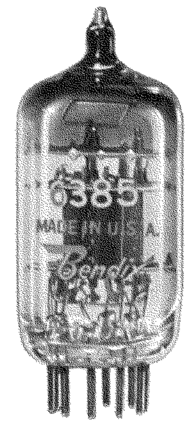
6385
Bendix Type TE-21
(Generic Type 5670)

RELIABLE MINIATURE DOUBLE TRIODE



RATINGS*

Heater voltage—(AC or DC)**	6.3 volts
Heater current	0.50 amps
Plate voltage—(max.)	300 volts
Max. peak plate current (per plate)	25 mA
Max. plate dissipation (per plate)	1.5 watts
Max. peak grid voltage	+0 volts —100 volts
Max. heater-cathode voltage	300 volts
Max. grid resistance	1.0 megohm
Warm-up time	25 sec.
Life expectancy***	10,000 hrs.

(Plate and heater voltage may be applied simultaneously)

*To obtain greatest life expectancy from tube, avoid designs where the tube is subject to all maximum ratings simultaneously.

**Voltage should not fluctuate more than ± 5%.

***See application notes.

PHYSICAL CHARACTERISTICS

Base	Miniature button 9-pin
Bulb	T-6½
Max. overall length	2³⁄₁₆ in.
Max. seated height	1¹⁵⁄₁₆ in.
Max. diameter	⅞ in.
Mounting position	Any
Max. bulb temp.	160°C
Max. altitude****	80,000 ft.

****See Altitude Rating Chart on page 3.

DESCRIPTION

This miniature nine-pin double triode is one of the Bendix Red Bank line of reliable vacuum tubes specifically designed for aircraft and industrial applications where freedom from early failure, long average service life, and uniform operating characteristics are extremely important. It is intended to replace the 2C51 or the 5670 in applications where reliability is the primary consideration. Each tube is given a 45-hour run-in under various overload, vibration, and shock conditions likely to be encountered in service. This run-in serves to reduce early failures by eliminating tubes with any minor defects that might lead to failure under actual operating conditions.

The use of a coil type heater inside an extruded alumina insulator gives a long life heater structure which stands up well under high heater to cathode voltage. The mount structure is so designed that the tube is capable of withstanding severe shock and vibration.

The tube is intended for use as an amplifier—to increase or control alternating voltages or power; as a mixer—to change electrical energy at one frequency to electrical energy at another frequency; or as an oscillator—to generate an alternating voltage. It can also be used in control equipment as part of a multivibrator or clamp circuit. When used as an oscillator, the upper limit of its frequency range is approximately 500 Mc.

This tube has been designed to minimize noise and microphonic effects.

AVERAGE ELECTRICAL CHARACTERISTICS

Heater voltage, E_f	6.3 volts
Heater current, I_f	0.50 amps.
Plate voltage, E_b	150 volts
Grid voltage, E_c	—2.0 volts
Plate current, I_b	8.0 mA
Mutual conductance, g_m	5000 μmhos
Amplification factor, μ	35
Cut-off voltage	—10 volts
Direct interelectrode capacitances (no shield)	
Plate-grid (per section)	1.7 $\mu\mu$f
Plate-cathode (per section)	1.1 $\mu\mu$f
Grid-cathode (per section)	2.4 $\mu\mu$f
Plate-plate	0.1 $\mu\mu$f

THE Bendix CORPORATION
Red Bank DIVISION, EATONTOWN, NEW JERSEY

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DOUBLE TRIODE

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ELECTRICAL CHARACTERISTICS AND TEST DATA

TEST CONDITIONS AND CHARACTERISTIC LIMITS

All Tubes are Stabilized for 45 Hours Under Test Conditions and 2 G. Vibration at 30 cps Prior to 100% Testing

CHARACTERISTIC	SYMBOL	MIN	DESIGN CENTER	MAX.	UNITS
PRODUCTION ON TESTS					
Heater Current	If	460	500	540	mA
Heater-Cathode Leakage	Ihk	—	—	±10	μAdc
Grid Current	Ic	—	—	—0.3	μAdc
Plate Current	Ib	5.5	8.0	11.5	mAdc
Transconductance	Sm	4000	5000	6500	μmhos
Trans. Ef = 5.7 v.	Sm	—	—	15%	
Cut Off Plate Current (Ecl = — 10 v. D.C.)	Ib	—	—	45	uAdc
DESIGN TESTS					
Short and Continuity					
Noise and Microphonics Ehk = 0 Ebb = 250 Ecl = 0 Ecal = 200 mVac Rp = 10,000 V	Ep			200	mVac
R. F. Noise				3.0	mWac
Electrode Insulation Eg-all = — 100 V Ep-all = — 300 V		500	—	—	Meg
Vibration 30 cps 2.5 g. Ecl = — 3 v. D.C. Rp = 2000 ohms Eb = 150 v. D.C.	Ep	—	—	100	mVac
Grid Emission Test Ef = 7.0 v.	Ic			—0.5	μAdc
Time = 5 minutes @ Ef = 7.5 V.	Cgp	1.4	1.7	2.0	μμfds
Capacitance	Cin	1.9	2.4	2.9	μμfds
	Cout	0.8	1.1	1.4	μμfds
	Cpp	—	—	0.15	μμfds

ELECTRODE:	Ef	Eb	Ec	Ehk
TEST CONDITIONS:	6.3 Volts	150 Vdc	—2.0 Vdc	±250 Vdc

SPECIAL TESTS

In addition to the production and design tests shown in Chart 3 other tests are performed on a sampling basis to assure a high outgoing quality level. See below.

TEST	CONDITIONS	DURATION
Heater Cycling Life Test	On 2½ Min. Off 2½ Min. Ef = 7.5 Ehk = 250	3,000 On-Off Cycles
Life Test	Under "Test Conditions"	1,000 Hours
Life "Expectancy" Test	Under "Test Conditions"	10,000 Hours
High Level Fatigue Test	50G—Shock Excitation 18/sec. rep. rate	100 Hours
Shock	500 g.	20 Impacts
Altitude Test	60,000 Feet	5 Minutes
Glass Strain Test	Boiling Water to Ice Water	15 Seconds in Each
Mount Inspection	100% Test—Microscopic Inspection of 30 Possible Trouble Points	

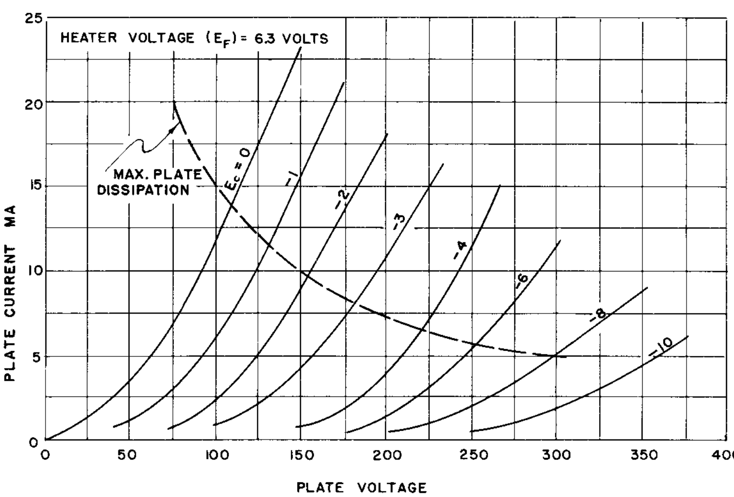
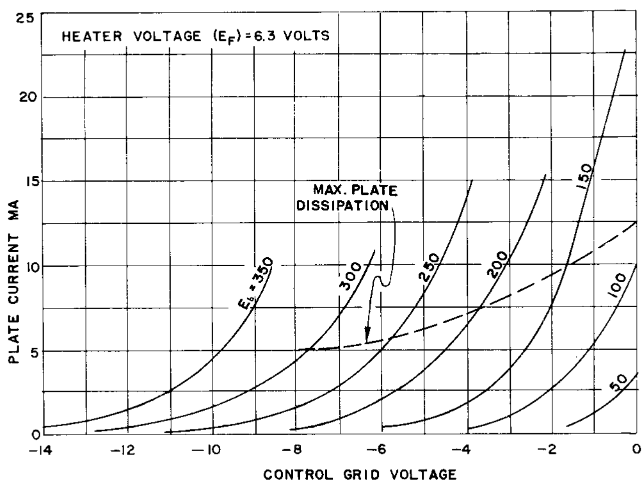


PLATE CHARACTERISTICS



TRANSFER CHARACTERISTICS

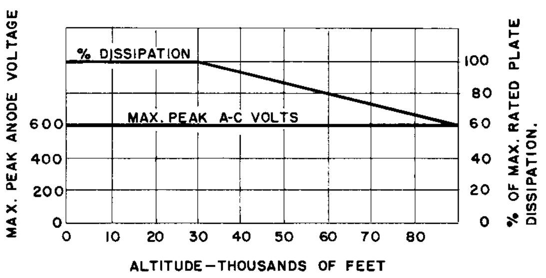
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ALTITUDE RATINGS



THIS CHART IS INCLUDED AS AN ILLUSTRATION OF THE AMOUNT OF DISSIPATION DERATING NECESSARY IN A SPECIFIC APPLICATION TO AVOID EXCEEDING THE MAXIMUM BULB TEMPERATURE. EACH APPLICATION SHOULD BE CHECKED TO DETERMINE THAT THE MAXIMUM BULB TEMPERATURE IS NOT EXCEEDED. EITHER DERATING OR COOLING OR BOTH MAY BE NECESSARY

CRITERIA FOR DERATING FOLLOWS:

1. VOLTAGE DERATING—TO KEEP BELOW BASE PIN ARC OVER POINT.
2. DISSIPATION DERATING—TO KEEP BULB TEMPERATURE BELOW MAXIMUM RATING.

EFFECT ON LIFE OF INCREASED RATINGS

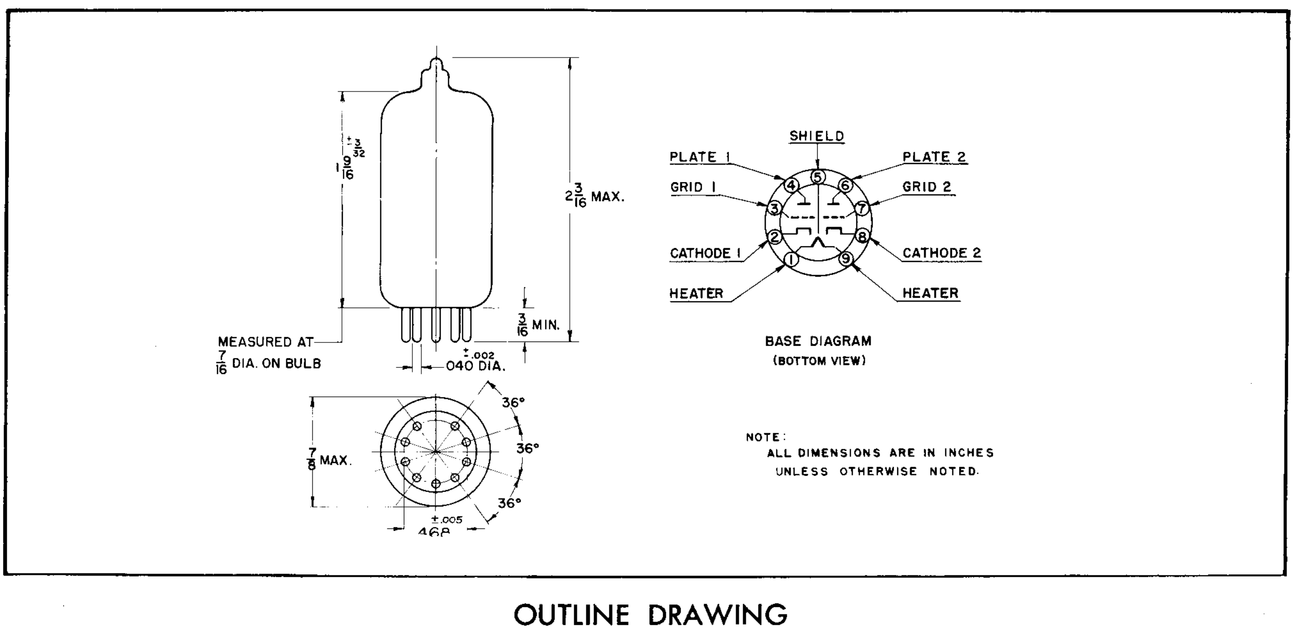
See also Application Notes	OPERATING CONDITIONS		
RATING OR CHARACTERISTIC	CONSERVATIVE	TYPICAL	MAXIMUM
Heater Voltage	6.3 ± 2%	6.3 ± 5%	6.3 ± 10%
Plate Voltage	130 Vdc	150 Vdc	180 Vdc
Peak Plate Voltage	200 V	250 V	300 V
Plate Current (Av.)	6 mA	7 mA	8 mA
Cathode Current (Peak)	15 mA	20 mA	25 mA
H-K Voltage	200 V	250 V	300 V
Grid Resistance	250,000 ohms	750,000 ohms	1,000,000 ohms
Bulb Temperature	120°C	140°C	160°C
Altitude	0-20,000 ft	60,000 ft	80,000 ft
Vibration	1 G	2½ G	5 G
LIFE EXPECTANCY	MAXIMUM	HIGH	MEDIUM

APPLICATION NOTES

Special attention should be given to the temperatures at which the tubes are to be operated. Reliability will be seriously impaired if maximum bulb temperature is exceeded. The life expectancy will be reduced if conditions other than those specified for life test are imposed on the tube and will be reduced appreciably if absolute maximum ratings are exceeded. Both reliability and performance will be jeopardized if filament voltage ratings are exceeded. Life and reliability of performance are directly related to the degree that regulation of the heater voltage is maintained at its center rated value.

The altitude rating chart shows the correct voltage derating necessary for various altitudes. However, the dissipation derating is only approximate and must be measured for each application because of the additive effects mentioned above.

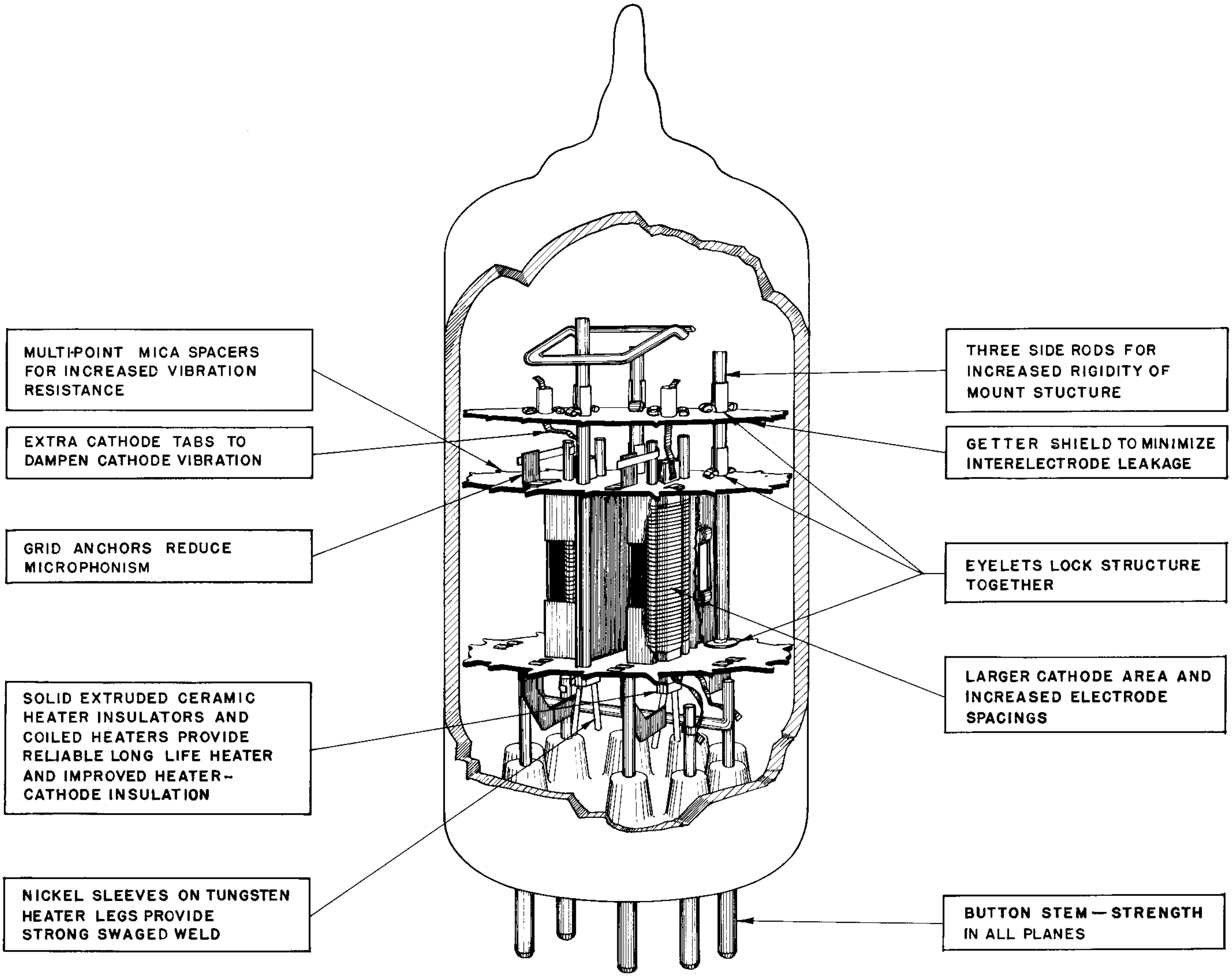
The increased rating chart is presented to emphasize the dangers of operating simultaneously at or near all maxima. In general, the effect on the life of operation at increased ratings is additive and cumulative. Interpolation within this chart will give the designer a general idea of the life expectancy and reliability of his application. Each proposed application should be life tested under maximum environmental conditions in order to check that the design gives the desired reliability. When conservatively used this tube has a life expectancy of 10,000 hours.



OUTLINE DRAWING

DOUBLE TRIODE

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STRUCTURAL FEATURES OF 6385 PROVIDE HIGH RELIABILITY AND LONG LIFE.

THE Bendix CORPORATION
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